

TREATMENT OF ACUTE ANTERIOR POLIOMYELITIS WITH CURARE AND INTENSIVE PHYSICAL THERAPY*

NICHOLAS S. RANSOHOFF

Orthopedic Surgeon, Monmouth Memorial Hospital, Long Branch, N. J.

INTRODUCTION

A YEAR has passed since the first complete report was made at the Orthopedic Section of the New York State Medical Society¹ of a method of treating acute anterior poliomyelitis from the onset of the disease, with curare and intensive physical therapy. Therefore it is fitting that another report be made on the second year's experience with this method of treatment. This is the first complete year's experience with the method as an entity. The first report included much developmental work. In treating the patients seen in 1946, the regimen² which was described last year was followed meticulously. The results have been most gratifying.

STATISTICS

Fifty-two patients were treated from June 1, 1946 through April 1, 1947. There were three deaths. This is a mortality rate of 6 per cent. One of these was a fulminating Landry's type ascending paralysis. The other two died with what our pathologist described as acute pulmonary edema. This is probably of the neurogenic type as described by Henneman.³ There are three fair results or 6 per cent. One is a patient who had a total quadriplegia with paralyzed abdominal muscles. There were numerous other factors in this patient, but her diagnosis finally was established as acute anterior poliomyelitis. She has recovered the use of her upper extremities and is beginning to show myographic evidence of power in her lower extremities. Her abdominal musculature is recovering nicely. The other two have major paralysis of muscles controlling one or more joints. It is to be noted here that the criterion

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From the Orthopedic Service at The Monmouth Memorial Hospital, Long Branch, New Jersey.

on which results are based is the evaluation of muscle power, *NOT* functional ability. The vagaries of estimating muscle power are great enough. When function is used as the criterion, the margin of error is too great to allow dispassionate evaluation. One patient, or 2 per cent, is classified as good. She has no total paralysis and only moderate involvement of the anterior and middle deltoid. She had had a total paralysis of that extremity. There are four patients or 8 per cent classified as very good results. These have minor pareses that require a well trained observer to detect the weaknesses. Forty-three patients, or 83 per cent, have excellent results, which means that there are no residua of the disease. In re-evaluating the percentages on the basis of those who lived, 47 of the 51 patients show very good or excellent results. This is 92.1 per cent.

PHYSIOLOGY

The concepts on which this method of treatment is based are elementary physiologic and orthopedic principles. These are:

- 1) A muscle which has lost its normal length (a short muscle) is a weak muscle. Deformities result because of short muscles.
- 2) Long continued spasticity or spasm will cause a muscle to become shortened.
- 3) Pain may be an etiological factor in muscle spasm. It is not the principal causative agent of muscle spasm or spasticity.
- 4) Sherrington's law of reciprocal innervation must be in effect for normal muscle action.
- 5) Normal circulation is necessary for the physiological return of muscle power.

It is thought that these concepts are best maintained by the use of curare, muscle stretching, active exercises, and activity from the onset of the disease or from as soon after the onset of the disease as possible.

No attempt will be made at this time to discuss the electrophysiology or electropathology of muscles affected by acute anterior poliomyelitis. All of these patients have been followed carefully and thoroughly with electromyographic studies. It is felt that this subject has no place in this presentation. A separate report of these studies will be made at another time. From the experiences with myography, it is apparent that certain of the published concepts will have to be reviewed carefully and, in all probability, be revised.

DIAGNOSIS AND DOSAGES

When a patient is admitted to the Monmouth Memorial Hospital at Long Branch, New Jersey, for observation as a possible acute anterior poliomyelitis patient, the procedure is as follows: A complete history and physical examination are done. An effort is made to determine the presence of muscle paralysis or paresis. Each joint is put through its range of motion to determine whether or not there is any loss of muscle length. A spinal tap is performed and, while the spinal fluid is being examined in the laboratory, myographic studies are made. If the diagnosis of acute anterior poliomyelitis is confirmed, the patient is given the first injection of curare while attached to the myograph machine; 0.9 unit of curare (Intocostin) per kilogram of body weight is administered intramuscularly every eight hours for the first twenty-four hours. After this period of time, the dosage is increased to 1.5 unit of Intocostin per kilogram of body weight every eight hours until all evidence of muscle spasm or spasticity has disappeared.

It must be emphasized that curare is NOT a "one shot remedy." From the nature of the disease, it should not be expected that one dose of this drug could possibly alleviate or obliterate permanently the hyperexcitability of muscle which is present. Therefore, it is necessary to administer the drug repeatedly until the disease has burned itself out and normal, or relatively normal, muscle and nerve physiology reestablished.

Much has been said, written and implied as to the dangers of curare. At the Monmouth Memorial Hospital, approximately 10,000 intramuscular injections of curare have been given to patients with acute anterior poliomyelitis. Its pharmacologic antidote, physostigmine, has been administered twice. It is doubtful that it was necessary either time. There have been no fatalities nor ill effects attributable either directly or indirectly to the drug.

PHYSICAL THERAPY

Physical therapy is instituted forty-five minutes after the first injection of curare. Each joint is put through a full range of motion or as nearly a full range of motion as possible at the time. This must be judicious stretching but pain is not the criterion of the amount of stretching necessary. The part is taken through its range of motion

until resistance is encountered. Then, with gradual pumping motions, that range of motion is increased as much as possible at that time. The amount of increase varies in each case, but it is a gradual increase, not an abrupt one which might result in torn muscle fibers, etc. *There never must be residual pain after stretching.* The stretching procedures are instituted three times after each daytime dosage of curare. The patients are taught to stretch themselves and one another. In addition to the stretching, active exercises are started immediately. Fundamental gymnastics of the Danish Group are utilized, stressing flexibility and coördination and getting strength coincidentally. It has been found that this approach to active exercises makes it more interesting for patients of all age groups. All activities are encouraged in order to keep the patients moving and busy. Occupational therapy, sports, tumbling, etc., form a part of the routine. Bed rest is discouraged except for febrile patients whose fevers are 102° or over. Mechanotherapy, hydrotherapy and electrotherapy are incorporated in the treatment.

FOLLOW-UP CARE

The follow-up care of these patients after discharge from the hospital is of the utmost importance. Each patient is required to report back for physical therapy daily. These patients are examined by a member of the staff at least once a week. The number of treatments per week is decreased as rapidly as the patient's condition allows. Any time that the attending orthopedists find evidences of retrogression, i.e., return of spasm as evidenced by loss of muscle length or muscle strength, curare is administered again as an aid to the reestablishment of normal muscle physiology. The physical therapy procedures, of course, have been continuous. All patients are examined at monthly follow-up clinics for at least the first year, when this is possible. It has not been possible to follow five of the patients. One, due to the fact that the family doctor frightened the mother about the after-effects of curare. One, because the grandparents insisted on prescribing the therapy. Two patients moved to Florida. The fifth patient was transferred to another institution. Her wedding announcement was received within eight months of this transfer.

Seventy-two patients, treated in 1945 and 1946, have been followed from the time of the onset of the disease to the present time with the following results:

- 1) No deformities have developed.
- 2) No braces have been used with the exception of a tongue spring for drop foot.
- 3) No crutches are being used.
- 4) Two patients use a cane occasionally.

PSYCHOTHERAPY

Psychotherapy is a most important part of this program. Every effort is made to make the patients feel at home in the hospital. Their own clothes are brought to them as soon as the isolation period is over. Favorite playthings, hobbies, etc., are brought to them from their homes. Toys, games and books are supplied. There is a combination radio-victrola for their use. The hallway becomes a parking lot for tricycles. For the children, meals are served on a long picnic table with benches. Birthdays always are celebrated with parties. The atmosphere never is allowed to be that of a sick room. The confidence and coöperation of the patient must be obtained by the physical therapists, the occupational therapists, and the nurses. Certain standards of behavior in treating patients with acute anterior poliomyelitis have been established. These are, in brief, as follows:

- 1) Never lie to a patient. If the patient is going to be hurt, tell him so.
- 2) Never bribe a patient in an endeavor to get his coöperation.
- 3) Make it a practice to spend some time in recreation with the patients daily. This may consist of roughhouse, reading, or innumerable methods of having the patients do things under the guise of play. This is essential so that the nurses and therapists do not become ogres, but maintain normal personal relationships with the patients. This is just as important for the adults as for the children. It is a real program based on elementary psychological principles.

CONCLUSIONS

- 1) It is believed that the described method of treatment of patients with acute anterior poliomyelitis will accomplish the following: (a) Shorten the period of hospitalization. (b) Decrease the number of personnel necessary to care for the patients. (c) Give better functional results. (d) Prevent deformities.

- 2) No claim is made that this is a cure for acute anterior poliomyelitis, but it is asserted that it is a better method of treatment.

(References on page 669)

<i>Nos.</i>	<i>Adm. #</i>	<i>Initial</i>	<i>Age</i>	<i>Pre-hosp.</i>	<i>Presenting Symptoms</i>	<i>Muscle Tightness</i>	<i>Muscles Involved</i>	<i>Type</i>	<i>Myo</i>	<i>Doses of Curare</i>	<i>Hosp. Days</i>	<i>Present Condition</i>
1	80151	DA	16 mos.	5 days	Temp., restless unable to walk, labored breathing.	Neck.	Intercostals, gluteals, hamstrings, quadriceps, tibials and triceps, surae peroneals and abdominals.	B	V	311	112	VG
2	82695	CSA	11 yrs.	4 days	Temp., headache, pain in back and r. arm, vomiting.	Back, neck, quads, strings.	Right triceps.	S	V	142	54	E
3	81097	NB	2½ yrs.	7 days	Temp., stiff neck headache, nausea.	Opisthotonos, hamstrings, tibials.	limping l. leg. All leg muscles weak.	S	V	36	19	E
4	81677	RB	6 yrs.	15 days	Limping, seen in clinic.	Neck, back, hamstrings.	Neck flexors, l. deltoid, hamstrings and quads, r. leg.	S	V	67	39	E
5	82920	PB	18 mos.	4 days	Slight ataxia, r. leg limp.	Hamstrings, back.	R. tibialis, neck, flexors,	S	V	118	51	E
6	83735	RC	4 yrs.	2 days	L. leg limp (ref. from Fit-kin).	Hamstrings, and back.	L. quads and hams, neck flexors.	S	V	216	85	E
7	83450	JC	7 yrs.	5 days & 5 on medical.	Unable to swallow.	R. shoulder, hamstrings, neck and back.	Tibialis, hamstrings, neck flexors. r. deltoid & triceps.	BS	V	111	58	E
8	80747	AC	9 yrs.	3 days	Cold, nausea, pain in neck & back, unable to stand or walk.	Hamstrings, back, neck.	Hamstrings, r. leg muscles, gluteals.	S	V	65	34	E
9	86169	DC	2 yrs.	3 days	Temp., sore throat, r. hip limp.	R. hamstrings & gastrocnemius.	Abdominals, neck flexors, r. hip flexors.	S	V	26	24	E
10	82474	HC	2 yrs.	2 days	Cold, unable to walk.	Hamstrings & back.	L. quads & hams.	S	V	57	27	E
11	80620	SD	3 yrs.	4 days	Chills, fever, unable to sit up unable to use r. arm.	Neck, hamstrings, back, r. arm.	Flail r. arm, abdominals.	S	V	500	193	G
12	80506	DF	6 yrs.	Ped 2 days	Cyanosis, twitching, temp. 103-105.	L. lower ext.	Intercostals, r. facial.	BE S	V	3	2	D
13	82241	CF	3 yrs.	3 wks.	Temp., nausea, unable to walk or stand.	Hamstrings, gastrocnemius, back.	Flail r. leg.	S	V	151	80	VG

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14	80918	KF	9 yrs.	10 days	Pain in thighs & limp, temperature.	Neck, left hamstrings, back.	Adductors l. and r., l. quadriceps and hamstrings.	S	V	90	37	E
15	81398	BG	6 yrs.	2 days	Headaches, temp., pain in neck, flail r. arm.	Hamstrings, back and neck flexors, r. arm.	R. arm—flail, r. tibial, gastroc., abdominals, quad.	S	V	225	109	VG
16	82319	JG	3 yrs.	3 days	Respiratory difficulty, unable to talk or swallow. Temp. 104.	Slight nuchal rigidity.	None.	B	No	2	1	D
17	83971	JG	2 yrs.	2 wks.	Cold, diarrhea, paresis l. leg, limps.	General.	L. hip & leg muscles all weak.	S	V	47	21	E
18	81220	LG	12 yrs.	5 days	Respiratory and swallowing difficulties, comatose.	General.	L. facial, intercostals and abdominals.	BE	V	106	41	E
19	82539	MG	18 yrs.	3 mos.	Fever, nausea, vomiting, paralysis l. arm.	General.	Deltoid (1) = 0.	S	V	84	36	E
20	81996	HH	16 yrs.	2 days	Paralysis lower exts.	General.	Complete paralysis.	AP	V	3	1	D
21	81304	EH	10 yrs.	8 days	Temp., swallowing difficulties, paralysis l. arm, stiff neck, nausea.	Hamstrings, neck and back, l. arm.	Flail l. arm, swallow muscles, abdominals.	BS	V	157	63	E
22	81305	HH	9 yrs.	4 days	Resp. difficulty swallowing difficulty.	Back, neck, hamstrings.	Abdominals, tibials, 1. biceps & triceps.	BS	V	145	63	E
23	79490	LH	15 yrs.	16 days	Sore throat Weak arm (R)	Hamstrings Sacrospinalis.	R. upper ext. 3+	BS	V	50	33	E
24	84451	MJ	22 yrs.	3 days	Cold, sore throat, stiffness, unable to walk.	None.	None.	S	V	76	34	E
25	84726	FJ	3 yrs.	2 wks.	Ataxia, unable to stand or walk.	Hamstrings, back and neck, heel cords.	R. leg muscles.	S	V	107	37	E
26	81291	AK	10 yrs.	6 days	Stiff neck, nausea, pain in legs. Unable to stand or sit. Headache, diarrhea, cramps.	General.	Flail r. arm and leg. Weak l. arm & leg. Abdominal leg flexors.	S	V	410	144	VG

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27	81139	GL	5 yrs.	2 days	Pain in l. knee and thigh.	Neck & back quadriceps. L. hamstrings.	Abdominals. L. iliopsoas. L. quadriceps.	S	✓	50	19	E
28	83893	RL	7 yrs.	4 days	Pain in left ear. Cold, unable to walk on l. leg.	Back and hamstrings.	Abdominals and quads.	S	✓	47	32	E
29	82616	WL	10 yrs.	2 days	Nausea, pain in neck, back and legs.	Hamstrings, sacrospinalis.	Abdominals.	S	✓	65	27	E
30		HM	7 yrs.	1 day	Pain in abd. about umbilicus.	Opisthotonos.	Neck flexors. Abdominals.		✓			
31	81761	JM	8 yrs.	11 days	Sore throat, stiff neck flail R. arm.	Back, hamstrings, wrist & finger flexors.	Flail arm (R).	S	✓	189	68	G
32	81173	RMcG	13 yrs.	3 days	Nausea, sore throat, headache, stiff neck and back.	Opisthotonos in general.	L. iliopsoas and hamstrings, triceps.	S	✓	140	51	E
33	81377	AM	35 yrs.	3 days	Vomiting, cold, headache, pain in knee, paralysis l. arm & leg, weakness r. arm & leg.	General.	L. arm and leg, abdominal, weakness r. arm and leg.	S	✓	135	50	E
34	83460	JM	6 yrs.	2 days	Pain in legs, limps on r.	Hamstrings, back & back.	R. quads & hip abductors.	S	✓	54	34	E
35	83730	EM	3 yrs.	3 days	Fever, sore throat, swallowing difficulty (convulsions for years).	Hamstrings, neck and back.	None.	BE	✓	105	193	E
36		JN	5 yrs.	?	Pain in neck, fever.	Nuchal rigidity. paraspinal.	None.	S	No	None.	3	E
37	86706	JP										
38	82318	PP	3½ yrs.	2 days	Pain in neck and back.	Pectorals, hamstrings, back and neck.	Abdominals and neck flexors.	S	✓	39	20	E
39	83231	SP	10 mos.	4 days	Sore throat & stiff neck.	Hamstrings, neck, back, tibials.	Flail r. leg.	S	✓	221	76	VG
40	81257	DP	27 yrs.	3 wks. other hosp.	Unable to move. Breathing and swallowing difficulty.	General.	Quadriplegia, abdominals.	BS	✓	517	249	F
41	82512	WR	5 yrs.	3 days	Abdominal cramps, Temp., pain r. leg. Unable to walk.	Neck, back, hamstrings, quadriceps.	Abdominals, neck flexors, muscles of r. leg.	S	✓	162	79	VG

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42	80183	RR	12 yrs.	4 days	Fever, malaise, vomiting, pain in back and both legs.	Neck and back, hamstrings, quadriceps.	Peroneals and toe flexors.	S	✓	138	50	E
43	83331	WT	26 yrs.	3 wks.	Headache, fever, unable to move, painful eyes.	Gastrocs, hamstrings, back and quadriceps.	Quads and tibials.	S	✓	70	35	E
44	86240	WV	2 yrs.	2 days	Fever, pain in legs & arms, r. hip limp.	None (?)	Abdominals, neck flexors, hip flexors.	S	✓	33	26	E
45	81015	JV	5½ yrs.	4 days	Fever, sore throat, pain in neck, stiff neck and back.	Neck, back, hamstrings.	Neck flexors, abdominals & serratus.	S	✓	48	23	E
46	81252	CW	5½ yrs.	8 days	Fever, sore throat, pain in neck, weakness.	Neck, back, gastrocs & hamstrings.	Neck flexors, abdominals.	S	✓	67	27	E
47	80607	WW	5 yrs.	4 days	Pain in legs, stiff neck, fever.	Neck and back, hamstrings & gastrocs.	Abdominals, neck flexors & tibials.	S	✓	138	54	E
48	*	SMcN	11 yrs.		Pain in back and leg. Walking with a limp.	Neck and back, hamstrings & quadriceps, gastroc. & tibial.	Back and right leg.	S	No	78	81	E
49	*	CMcN	13 yrs.		Pain in back.		Back muscles.	S	No			E
50	*	H	14 yrs.		Pain in leg, unable to walk.		Right leg.	S	No	42	18	E
51	*	IH	22 yrs.		Opisthotonos, pain in back, headache, pain in chest.	Neck & back, hamstrings, & pectorals.	Neck flexors and back muscles.	S	No	57	61	E
52	*	RS	4 yrs.		Pain in l. arm and unable to use it.	General.	Biceps, triceps & deltoid.	S	No	45	20	E

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